

GEO 383S. SEDIMENTARY BASIN ANALYSIS ("Dynamics & Infill of Sedimentary Basins")

Instructors:

Lectures: 2-5 pm Wednesday, GEO 2.202.

Brian Horton: horton@mail.utexas.edu; Geology 5.220A; Office hours: 1-2 pm Wed, 3-4pm Thu, or by appointment.

Ron Steel: rsteel@mail.utexas.edu; Geology 6.114; Office hours: 11-12 noon Mon/Wed, or by appointment.

Required Text:

Allen P.A. & Allen J.R., *Basin Analysis*, Blackwell, 2005 (1990).

Other Useful Texts:

Turcotte D.L. & Schubert G., *Geodynamics*, Wiley & Sons, 2002 (1982).

Watts, A.B., *Isostasy and Flexure of the Lithosphere*, Cambridge, 2001.

Angevine C.L. et al., *Quantitative Sedimentary Basin Modeling*, AAPG Short Course Notes 32, 1990.

Leeder, M.R., *Sedimentology and Sedimentary Basins: From Turbulence to Tectonics*, Blackwell, 1999.

Miall A.D., *Principles of Sedimentary Basin Analysis*, Springer Verlag, 1999.

Einsele, G., *Sedimentary Basins*, Springer Verlag, 2000.

Allen J.R.L., *Principles of Physical Sedimentology*, Chapman and Hall, 1992.

Yergin, D.H. *The Prize: The Epic Quest for Oil, Money, and Power*, Simon & Schuster, 1992.

Prerequisite:

Graduate standing and GEO 383 (Depositional Systems: Terrigenous Clastics) or equivalent.

Purpose of Course:

To deliver a theoretical and practical understanding of how sedimentary basins develop and how they can be studied to determine tectonic, climatic, and eustatic controls on subsidence, surficial processes, and infilling. We will discuss quantitative models for flexural and thermal subsidence, isostasy, and various basin classification schemes. We will also address methods for determining sediment dispersal patterns, provenance, basin paleogeography, and sediment accumulation history. We plan to introduce you to straightforward computer programs (Matlab, Excel, etc) that provide useful tools for quantitative basin modeling.

In the second part of the course (group-project oriented), we will analyze several different types of sedimentary basins in terms of tectonic setting, subsidence mechanisms, large-scale stratigraphic architecture, paleogeography and basin resources. Coursework will include readings and presentations from required and supplementary texts, completion of several problem sets, a midterm exam, and a final project involving a written report and oral presentation.

Grade Policy:

Evaluation for the first half of the course will be based on one midterm exam (20%) and three problem sets (30%). Evaluation for the second half of the course (50%) will focus on oral presentations of relevant article, and a final written report with corresponding oral presentation (50%).

Field Trip:

One 5-6 day field trip is planned for the latter part of April (tentatively 21-25 April), possibly in the Sevier (Cordilleran) foreland basin of Utah (including Book Cliffs) where we will observe an east-west transect from proximal to distal outcrops and consider the interplay of tectonic, eustatic, and climatic controls on the basin. Details will follow.

Course Content: (by week)

1. Sedimentary basin analysis: history, basin classification, plate tectonic settings.
1. Constitution of Earth, lithosphere mechanics, isostasy.
2. Flexure of the lithosphere: theory and modeling applications [introduction to Matlab program].
- 3-4. Basins formed by flexure: foreland basins, thrust belts, critical-taper models, dynamic subsidence.
4. Thermal subsidence of the lithosphere.
5. Basins formed by extension: rifts, supradetachment basins, extensional collapse.
5. Strike-slip/pull-apart basins.
6. Quantitative subsidence analysis [introduction to Excel program].
7. Sediment provenance and provenance modeling; paleocurrents and sediment dispersal patterns.
7. Additional plate tectonic settings (trench, forearc, intra-arc, and intracratonic basins).
8. Mid-term exam (March 10)
9. Spring Break (March 15-19)
10. Syn- & post-rift basins in the North Sea (March 24)
11. Extensional collapse Devonian Basins, N. Europe (March 31)
12. Anatomy of a deepwater Laramide Basin, Wyoming (April 7)
13. AAPG week
14. Possible Foreland Basin Trip, Utah-Colorado (21-25 April)
15. Project presentations (April 28)
16. Project presentations (May 5)